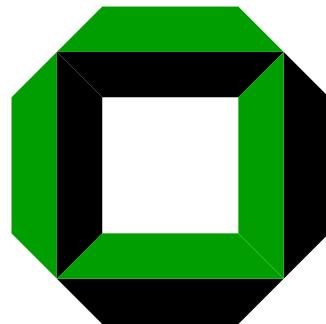


Combined objects - A new algorithm for energy measurement @ CDF II using tracks and calorimeter towers



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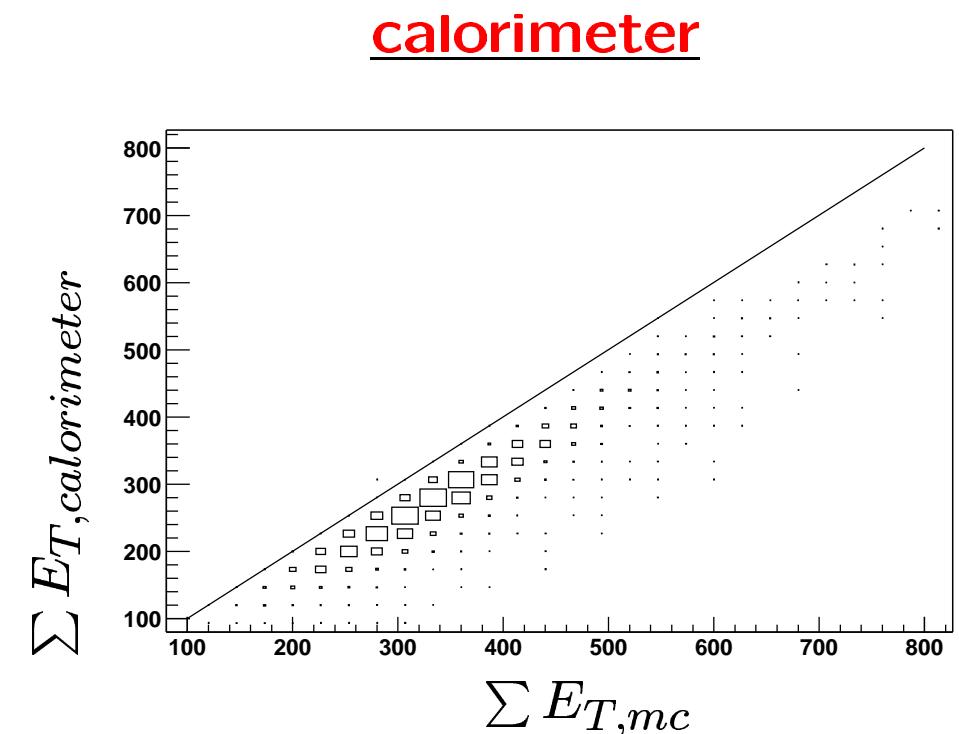
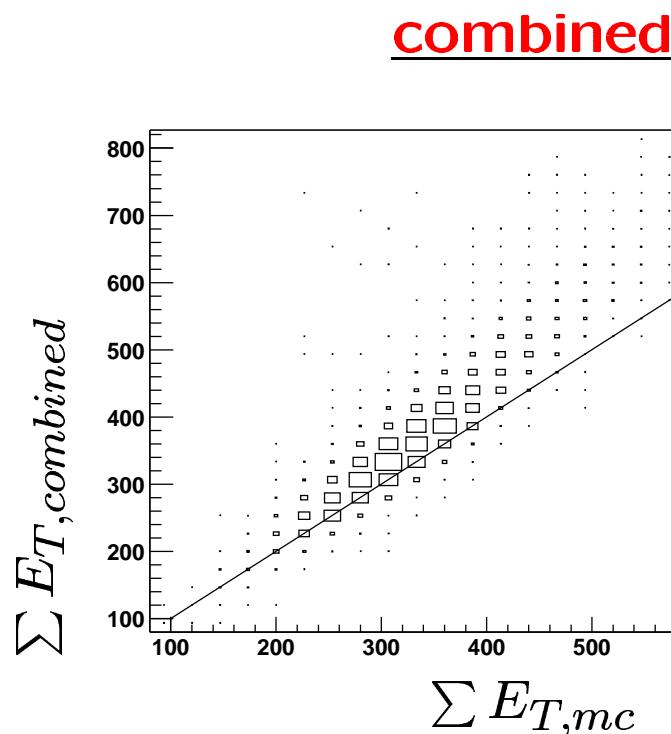
CDF Dijet mass meeting 07/03/2003

Overview

1. Motivation
2. The algorithm
3. Track influence
4. Energy measurement
5. Outlook

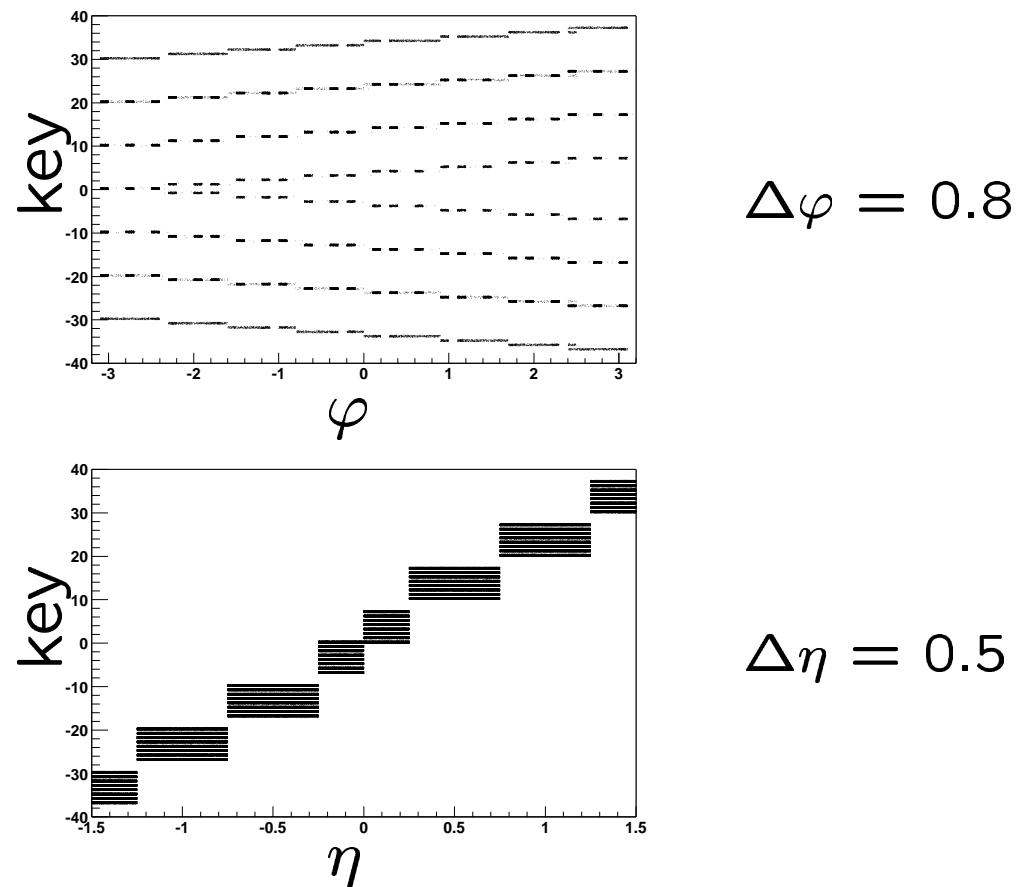
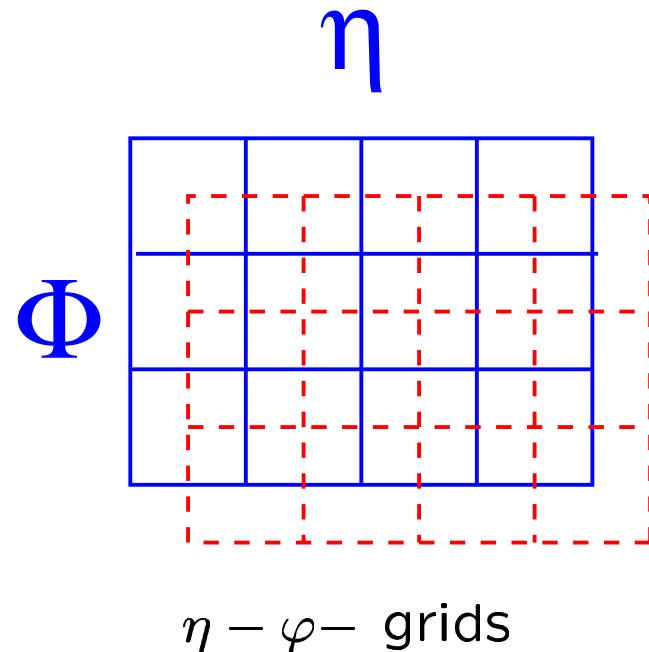
Motivation

- Goals:
 - Improve energy measurement
 - Reduce corrections afterwards
- Way: use both calorimeter information and track information
- First result:



Algorithm (1) - Preparations

- Problem: large calorimeter surface \rightarrow slow iteration
- Solution: lay coarse grid(s) over it



Algorithm (2) - data and environment

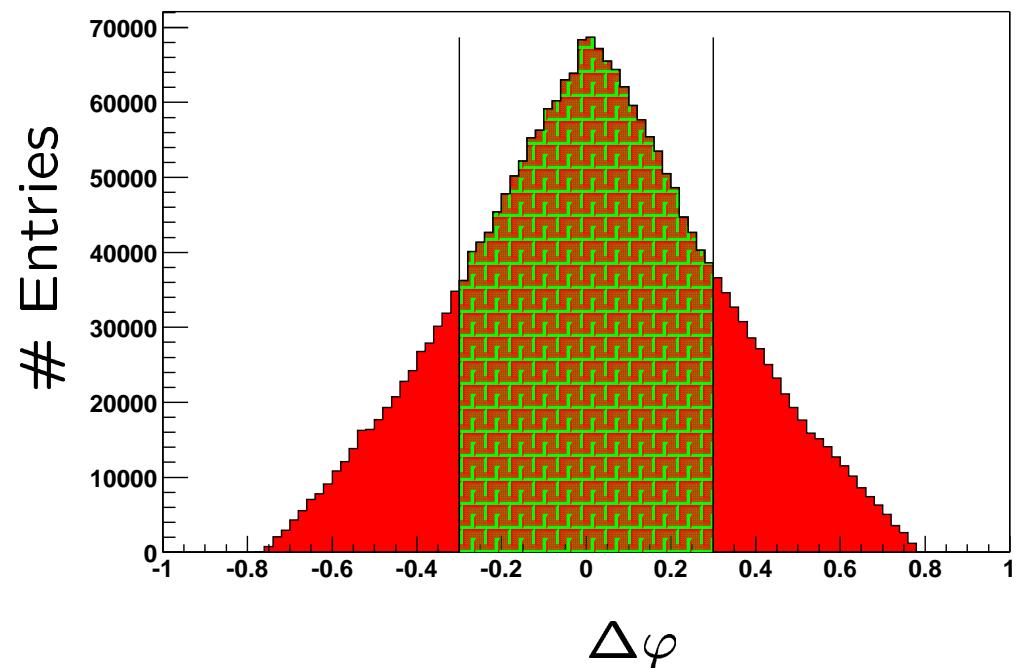
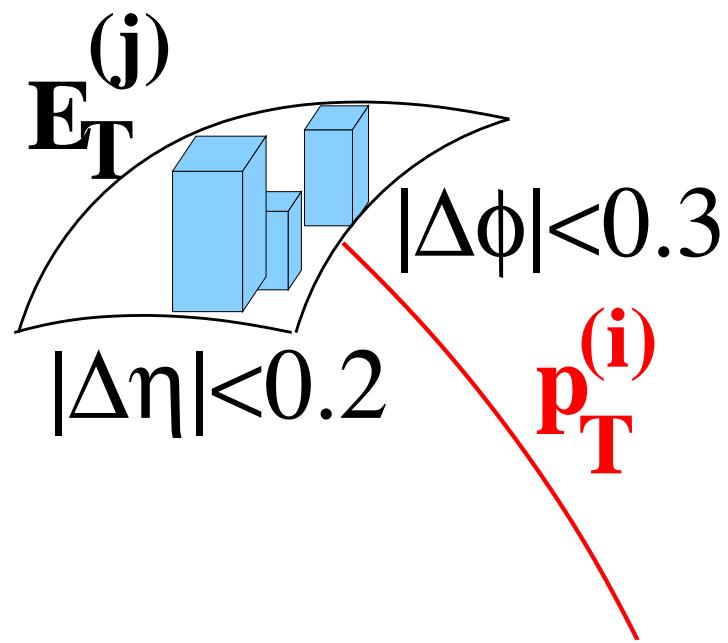
- Fill CDF Stntuple data in the analysis toolkit PAX (Physics Analysis eXpert)
- PAX is an analysis tool offering a new level of abstraction beyond the detector reconstruction
- Create a fourvector for each entry (E, p_x, p_y, p_z)
- For the combination we use the central region:
 - TCalTower with $|\eta| < 1.5$
 - TStnTracks with $|\eta| < 1.2$

Algorithm (3) - Track extrapolation

- Using the TSimpleExtrapolator of the Stntuple each good track is re-extrapolated until CES is reached
- A good track is defined by:
 - $p_T > 0.8$ GeV and
 - either COT hits > 15
 - or SVX hits > 4
- Recalculate p_T of each successfully extrapolated track by using its vertex position
- Determine $\eta - \varphi$ -key for this track

Algorithm (4) - Preselection

- Loop over extrapolated tracks, starting with highest p_T
- From coarse $\eta - \varphi$ - grid to $\eta - \varphi$ -island:
 - Compare calorimeter tower and track with same $\eta - \varphi$ -key if $|\Delta\varphi| < 0.3$ and $|\Delta\eta| < 0.2$
 - $\sim 50\%$ of the fourvectors fulfill this criterion on the coarse grid



Algorithm (5) - Decision

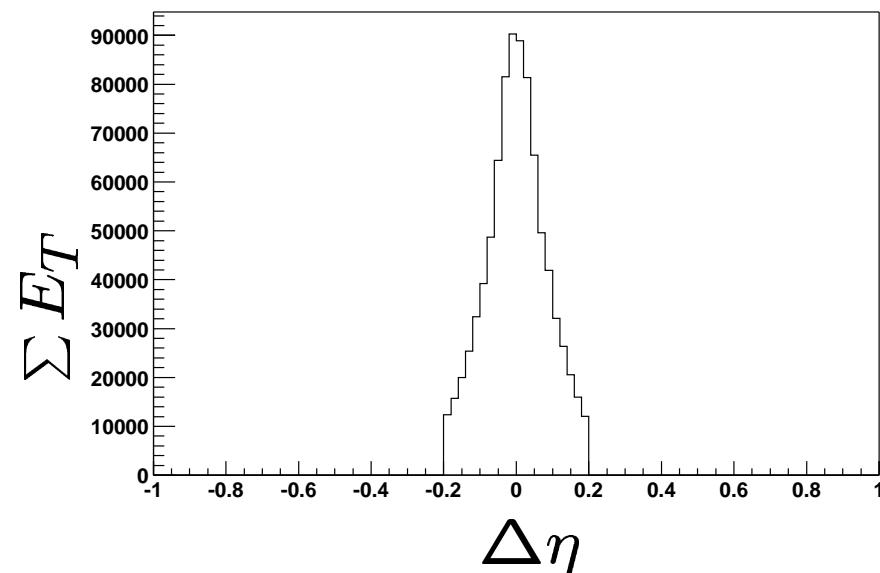
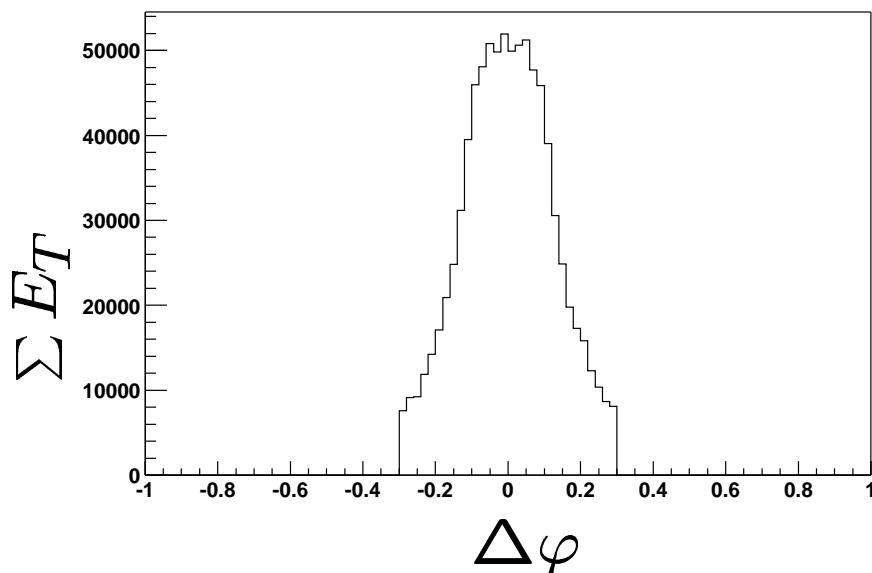
- Sum up (remaining) calorimeter energy on the island ($E_{T,island}$)
- Question: Is $E_{T,island} > p_{T,track}$?
 - If answer is "yes": calorimeter wins
 - If answer is "no": track wins
- Compare p_T of track with (remaining) E_T of the calorimeter tower the track points to (\rightarrow starting point of association)

Algorithm (6) - create combined object

- If calorimeter wins:
 - Associate track to tower(s) with closest E_T until calorimeter E_T exceeds track p_T
 - Build a new combined fourvector
- If track wins:
 - Use original track information
 - Associate calorimeter E_T to track until track p_T exceeds calorimeter calorimeter E_T
 - Build a new combined fourvector
- Clean up: Add all unused calorimeter towers, tracks,...

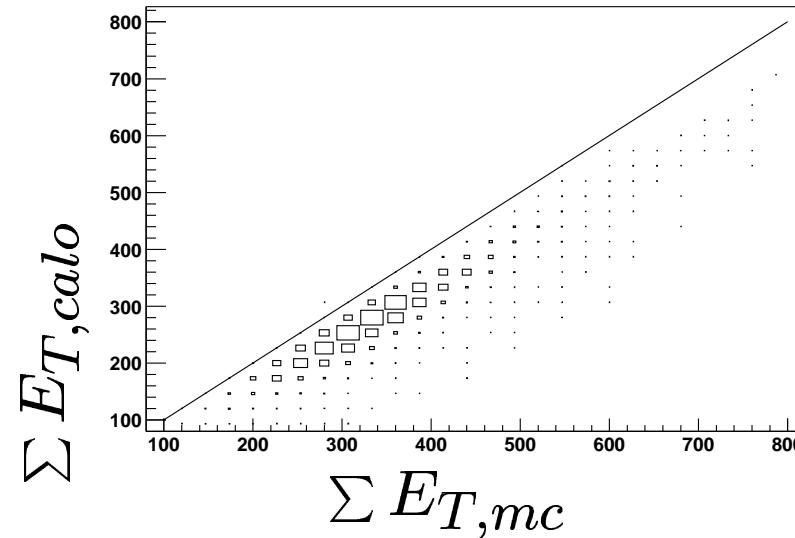
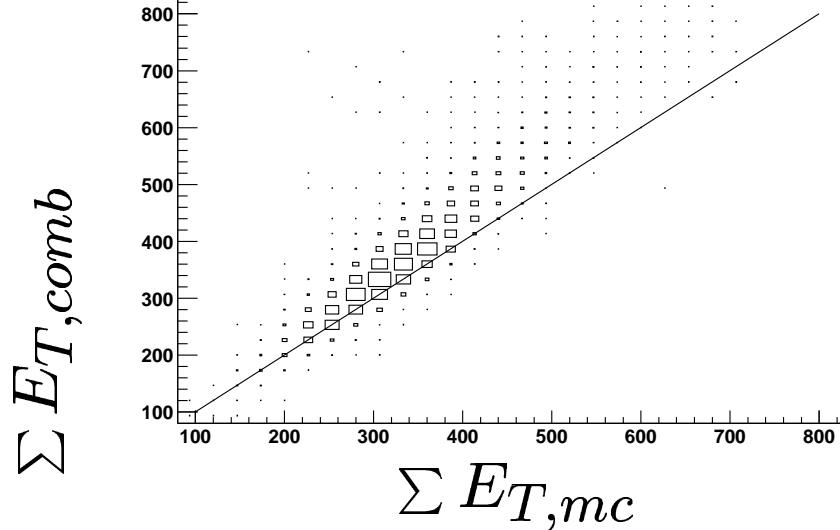
Algorithm (7) - Associtation quality

- Quality of spacial association between calorimeter towers and tracks after combination



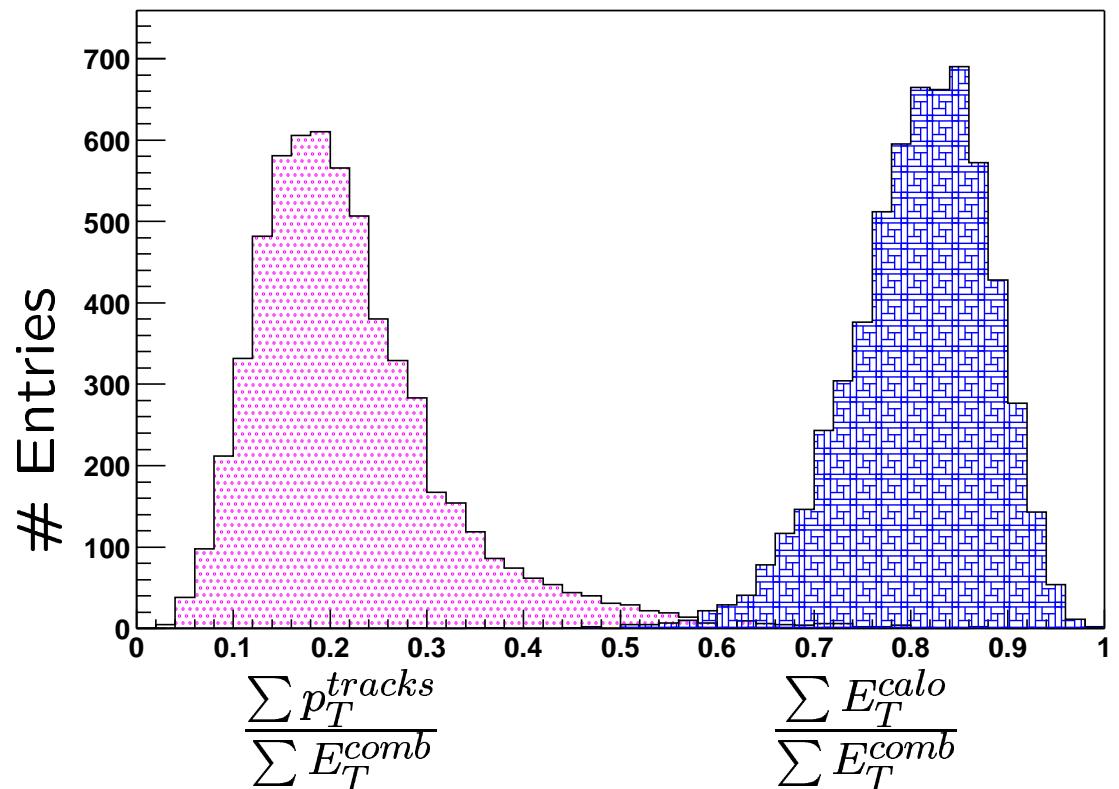
Energy analysis (1) - $\sum E_T$

- PHYTHIA $t\bar{t}$ monte carlo



Energy analysis (2) - Fraction of tracks

- Magenta: Tracks contribute to 20% to the energy within $|\eta| < 1.2$



Outlook

- Fine tuning to fit mc truth
- Extend algorithm to forward region
- Apply algorithm to jets,...
- Understand systematics